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*Proceedings of*

# NORTHEAST CLIMATE HUB PARTNERS MEETING

**RUTGERS UNIVERSITY**

Rutgers University | New Brunswick, NJ | March 14-15, 2018

Produced by Gulnihal Ozbay, Rose Ogutu, and Asia Hasan of Delaware State University, Cooperative Extension, Dover, Delaware and Erin Lane and Karrah Kwasnik, USDA Northeast Climate Hub

Layout and design by Karrah Kwasnik

Photo: Dead loblolly pines cast shadows over salt marsh at Blackwater National Wildlife Refuge in Dorchester County, Maryland on June 5, 2018. Sea level rise and land subsidence result in brackish water intruding on forested land and killing trees. Credit: Will Parson, Chesapeake Bay Program

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**Northeast Climate Hub**  
U.S. DEPARTMENT OF AGRICULTURE

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LISTEN



WATCH



SLIDE DECK



*Researchers at URI are looking into summer cover crops; Japanese Millet (above) is one option being explored. Photo: USDA Northeast Climate Hub*

## CONFERENCE SYNTHESIZERS

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## OVERVIEW AND GOALS

Hosted by the USDA Northeast Climate Hub and partners, the intent of this meeting was to examine the state of our knowledge on climate adaptation and to promote actions to support agriculture in our region.

We targeted our unique challenges and opportunities based on the climate science most relevant to the agricultural context of our region. The USDA Northeast Climate Hub and partners invited participants from university, federal and state agencies, and the private sector. Extension and outreach professionals were the primary audience. We also invited researchers, farmers, and other practitioners to provide their perspectives on climate adaptation and resilience. Building upon the foundational understanding of climate trends and impacts, participants investigated solutions by sharing adaptation experiences and discussing their feasibility, tradeoffs, and cost-effectiveness. Altogether, we hope this meeting aided the Northeast community in an exchange of information that will drive continued collaboration and advancement of climate adaptation in agriculture. This initial workshop focused on sharing adaptation experiences in agriculture and forestry, discussing outreach strategies, and developing a community of practice. Future meetings may consider expanding upon these themes.

In 2015, the NE Hub and partners assessed the current and future capacity of research and Extension faculty and staff at land-grant universities across the Northeast to address climate change issues in the agricultural, natural resource, and forestry sectors. Through this effort, we determined the need for bringing together Extension professionals within the region to share and closely examine the details of available climate information and the feasibility of concrete adaptation strategies. Based on this background information, we developed objectives for our partners meeting.

These proceedings document our experience as we endeavor to both summarize and synthesize the overall resulting messages that were exchanged. These proceedings are devised from notes taken by synthesizers and may not have captured the sentiment of all presenters or participants. The goal of this text is to document the take home messages, which will help lead us to future workshop themes or other collaborative productions. While we tried to be accurate and concise, some errors or note-taker bias may be present.

### MEETING OBJECTIVES:

- To share experiences in adapting to climate impacts and foster peer-to-peer learning through the multi-directional exchange of information among Research, Extension, and farmers/practitioners in the Northeast.
- To collaboratively strategize how to best support science-based and cost-effective adaptation in the context of current climate science.
- To support and formalize the growing Community of Practice around climate adaptation in agriculture in the Northeast.





# DAY 1

MARCH 14, 2018

Day neutral strawberries continue to ripen in September on UNH's Woodman Horticultural Research Farm in Durham, NH  
Photo: USDA Northeast Climate Hub



## WELCOMING REMARKS

Both speakers welcomed guests and addressed the importance of having discussions on climate change aimed at how we can help make communities resilient and prepare them for a changing climate.

The speakers also highlighted the importance of having a conference of this nature and scale. Overall, the speakers felt that solutions to climate change will (continue to) require globalization and innovative approaches to the practices currently being used across farms, businesses, homes, and schools.

### ROBERT M. GOODMAN

Executive Dean of the School of Environmental and Biological Sciences, and Executive Director of the New Jersey Agricultural Experiment Station at Rutgers, shared the story of the University's initial mission to build a new program within food nutrition and health focused on climate. Thus, Rutgers' Climate Institute was born.

### DEBASISH DUTTA

Chancellor, Rutgers University, shared his mission (as a land grant institution) to lead and inform policy makers with facts and figures. His goal is to make Rutgers a national leader and innovator, and to engage in a cross-pollination of issues.

## KEYNOTE SPEAKER



### CLIMATE CHANGE IN A CHANGING CLIMATE

*Dr. Randi Johnson, USDA NIFA Director of Global Climate Change*

Dr. Johnson started by highlighting that the USDA Climate Hubs are crucial to the USDA and its 'One USDA' vision as they are the epitome of agency collaboration. This administration values the Climate Hubs as they are helping with key USDA priorities. Currently, USDA's Climate Change Program Office and NIFA's Division of Global Climate Change are focusing on sustainability and water quality. Dr. Johnson recommended researchers and extension frame what they do in grant proposals to fit the current priorities. Participants are encouraged to check out the Climate Science Special Report – 2017 (National Climate Assessment 4).

Dr. Johnson stated, "Climate change is still a valid topic in USDA." She emphasized that how you frame the conversation is important. "What we are doing is important, but we have to frame it right. We need to recognize need for strong resilient rural economies. We also need to talk about what is important to our stakeholders." USDA focuses on economic solutions specific to the US, as evidenced by the Farm Bill and legislative priorities. Think about focusing your research and outreach in economic terms. For example, what are ways to reduce crop insurance costs? She mentioned regulatory reform that requires good conversation with the farmers and policy makers. If a farmer keeps water and nutrients in the field rather than the streams, it makes farmers happier and then they aren't impacted by regulation.

## CLIMATE TRENDS AND RELATED RISKS IN THE NORTHEAST

*Facilitated by David Hollinger, USDA Northeast Climate Hub*

This session set the stage to get us all on the same page regarding how the climate is changing and what that change means for impacts to agriculture in our region.

Presenters focused on shifts in atmospheric CO<sub>2</sub> concentration, temperature, and rainfall. How do these affect crop production, growing season, animal health, and overall farm production? How are climate trends influencing farming operations? Measurable changes and associated economic impacts can easily be seen. In order to adapt, change in farming practices and infrastructure are needed. In the Midwest, farmers are buying bigger equipment to adapt to climate change, which means they are significantly investing in adaptation methods. Farmers may better succeed in a changing climate by using new decision tools and field sensor tools.

Discussion in this session included suggestions for focusing on high risk factors with climate change (i.e. drought). Climate change is difficult to predict, and climate events have different risk factors like drought, frost, flooding, and warming winters. More information can therefore help farmers avoid high economic losses. In addition, data-driven decision tools and programs that can support small farmers are especially needed.



*Farm Manager, William DellaCamera checks a corn earworm trap on Cecarelli Farms in Northford, CT in July 2018. Photo: USDA Northeast Climate Hub*





Gail Livingstone took ownership of Rainbow Hill Farm in 2010, a 19+ acre organic farm in Jefferson County, West Virginia. Photo: Will Parson, Chesapeake Bay Program

Take home messages of this session include but are not limited to:

- > Regional shifts in livestock business are taking place currently. Heat stress decreases dry matter intake in cattle, which reduces production.
- > Farmers and home gardeners can use climate data to make informed decisions. The frost-free period can be offset from normal and there is increased pressure of weeds and pests. Due to increase in temperature, each season might be a month longer than traditional timings by the end of this century. A longer frost-free season does not necessarily mean a longer growing season, if it rains and the water cannot be properly absorbed by the land because of frost.
- > Plant breeding and biotechnology is crucial to find strategies to adapt to climate change, but it is not a silver bullet.
- > Currently, there are financial, informative, cognitive, technological, social, cultural and ecological barriers for adapting to climate change. It is important to understand when to adapt to climate change and what it will cost. Small farmers may be more likely to go out of business trying to cope with climate change.

### Session presentations:



#### CHANGE IS IN THE AIR: NORTHEAST U.S. AGRICULTURE IN A CHANGING CLIMATE

*Arthur DeGaetano, Northeast Regional Climate Center*



#### CLIMATE CHANGE VULNERABILITIES, OPPORTUNITIES AND ADAPTATION STRATEGIES FOR NORTHEAST CROPS

*David Wolfe, Cornell University*



#### CLIMATE CHANGE EFFECTS ON LIVESTOCK IN THE NORTHEAST U.S. AND STRATEGIES FOR ADAPTATION

*Alex Hristov, Pennsylvania State University*



#### PREPARING TO ADAPT

*David Hollinger, USDA Northeast Climate Hub*

## IDENTIFYING IMPACTS AND ADAPTATION IN THE NORTHEAST: EXAMPLES FROM ACROSS THE REGION

These four presentations focused on climatic changes happening to farming, and how farmers can be prepared to adapt to those changes.



### FARMING IN A NEW WEATHER REALITY: FARMER STORIES FROM MAINE

*Sonja Birthisel and Ellen Mallory, Maine Climate and Agriculture Network, University of Maine*

Communication between farmers, extension staff, research faculty scientists, and government agencies is critical to help farmers succeed under our changing climate. In this presentation, we heard about several outreach activities on farming operations in Maine (with focuses on sheep and fiber, honeybees, turf, and vegetables). Some of the climate impacts that Maine farmers are facing include: increased heavy precipitation, longer growing seasons, lengthier and milder winters, cooler and wetter springs, summer droughts, and an increase in ice storm frequency.

Sheep farmers in Maine face intense storms, or ‘killing rains,’ which impact herd health and hurt yarn production. One adaption to this is to alter lamb and sheep production timing to strengthen the herd during vulnerable times. These heavy rains are also causing erosion, which limits field access for many mixed vegetable, apple, and berry farmers. Adaptation strategies include the use of permanent raised bed systems and/or adjusting the bed orientation. Many orchard fruit farmers are most concerned with the increase in pests and disease outbreaks. While the growing seasons in Maine are, on average, getting longer, many turf farmers are particularly concerned about droughts and bee farmers are concerned about plant flowering periods.



### ASSESSING ADAPTIVE CAPACITY OF FARMERS IN THE PIONEER VALLEY

*Angelica Carey, Master of Regional Planning and Sustainability Sciences, University of Massachusetts*

Carey shared her experience in a pilot study to assess adaptive capacity of farmers. Resilience should be measured from multiple angles including social/or societal, economical, and environmental capacities. For example, a farmer’s personal knowledge might help them plan an action, but resources can help them better respond and take an action. With this in mind, Angelica concentrated on three adaptive capacities: knowledge, action, and resources. Assessment of 10 farmers with a 12 question survey focused on how a farmer would develop components of adaptive capacity to improve their ability to farm now and in the future. The farmers who participated in the pilot study believe climate change is occurring and that it affects the way they do farming. Heavier precipitation, stormier weather, and drought during the summer were impacts most noted by farmers. These farmers were also concerned about irrigation and soil manipulation techniques, costs of changes in relation to labor, and more. However, taking “action” was identified as a major gap, and taking action at the right time was another gap identified with farmers.



### ASSESSING CLIMATE CHANGE IMPACTS TO AGRICULTURE IN DELAWARE

*Jennifer DeMooy, Climate Adaptation Project Manager, Delaware Division of Energy and Climate*

DeMooy provided an overview to some of the assessments on climate change’s impact on farmers in Delaware (and places with a ‘Delaware type climate’). Climate characteristics are unique to Delaware as it is in a transition zone between the Northeast and Southeast. Some of the issues common to →

Delaware with other Northeast states include: heat impacts on animals, heat and changing rainfall impacts on crops, increased weed, insects and pests in the field/ crop predation, land use limitations due to sea level rise, and nutrient loss in soils due to heat and changing intensities of rainfalls. One of the gaps addressed in this presentation was that farmers should be provided sufficient information and education to know where to obtain accurate information on specific climate change issues.



### ADDRESSING CLIMATE CHANGE: ON-FARM LESSONS AND PRACTICES

*Pam Mount, Farmer, Terhune Orchards, Lawrence, NJ*

Pam Mount shared her own experiences running a diverse large-scale farming operation, including her lessons learned and practices applied. Her orchard's primary focus is on apple, peach and pear cultivation. She has been able to sustain her farm practices all year-long by using high tunnels and greenhouses to protect her crops and expand their grow-out timeline. According to Pam, small farms start with the family, and taking action is slow in family-run farms. Taking an action that is addressed as a gap can make a farmer hesitate, especially if they do not have enough background on it. How do we think ahead, for future generations? Pam suggested diversifying the farm operations. To illustrate what she meant by this, Pam shared her experience in starting as an orchard owner, and then expanding to open a farm market, bakery, and winery. Lesson learned from her experience is to become a steward of your farm, enjoy your own crops, and learn skills to maximize your profits by providing a variety of options to your customers.

### Take home messages of this session:

- Adaptation is specific to each farmer and could be focused on infrastructure, farming system, meeting market demands, or making changes in soil quality and crop types.
- Smaller farms are often disproportionately impacted by climate change. Appropriate action at the right time depends on how much knowledge farmers have on climate change and the resources that are available to them. Both the start-up expenses for changing an operation and the skill-set to implement the change are needed for action.
- Farmers need to understand and use climate indicators in order to start planning and building-in adaptation strategies on their farms.





# HOW DO WE ADAPT?

For this part of the agenda, we came together to exchange information, share solutions, and encourage action among participants and those they serve.

The meeting design included three session blocks each with three concurrent sessions - for a total of nine sessions. Each session focused on a theme and hosted two to four speakers. The focus within each session was to share informed ideas, tools and tactics for adapting to climate change within our region.

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*(Left) A corn earworm feeds on a corn cob infected with corn smut. USDA-ARS photo: Eric Schmelz. (Right) Flooded fields in Sussex County, Delaware in May, 2018. Photo: Michele Dorsey Walfred.*



## CLIMATE INFORMED DECISION MAKING IN A RAPIDLY CHANGING CLIMATE

*Facilitated by Jennifer Volk, University of Delaware and Anthony Buda, USDA Agricultural Research Service*



### NOAA'S WEATHER AND CLIMATE INFORMATION FOR AG PRODUCERS AND LAND MANAGERS

*Ellen McCray, NOAA Regional Climate Services Director - Eastern Region*

Ellen McCray is one of NOAA's six Regional Climate Services Directors and part of the National Centers for Environmental Information (NCEI). Art DeGaetano delivered this talk as Ellen McCray was absent due to the weather. NOAA plays the crucial role of collecting and organizing climate data across the country. Farmers can access weather information relevant to their exact location, which can help them to make informed decisions for their farming methods.



### CORNELL'S CLIMATE SMART FARMING TOOLS: HELPING NEW ENGLAND PRODUCERS REDUCE CLIMATE RISKS ON FARMS

*Allison Chatrchyan, Director of the Cornell Institute for Climate Smart Solutions*

Allison Chatrchyan is a Sociologist at Cornell University and her work focuses on bridging the gap between scientists, data, farmers, and climate smart decisions. Her talk was focused on "Climate Smart Farming Tools," which is hosted at [climatesmartfarming.org](http://climatesmartfarming.org). Here, there are varieties of searchable historical data that can help farmers make informed decisions specific to their area.



### SUPPORTING AG-WEATHER DECISIONS IN DELAWARE

*Kevin Brinson, Associate State Climatologist and Director of DEOS, University of Delaware*

Kevin Brinson is the Director of the Delaware Environmental Observing System at the University of Delaware. The Center for Environmental Monitoring & Analysis (CEMA) has been collecting climate data for over 15 years to aid farmers and other interested parties in making decisions and responding to extreme weather conditions. Kevin aims to integrate data with other similar projects in an efficient manner. An identified gap in the process is how to convey this data to all appropriate parties and to avoid duplication of labor.

### Take home messages of this session:

- There is a need for integration of research data while utilizing in-depth climate information resources websites. Since the technology in use involves databases and upkeep, funding is necessary to keep the programs running.
- Sensors are becoming better; however, there needs to be more inclusiveness of different types of data that would benefit farmers even more in times of extreme weather conditions.

## USING WEATHER DATA TO ADAPT

*Facilitated by Lynn Knight, USDA Natural Resources Conservation Service and Rose Ogutu, Delaware State University*

This session focused on building agricultural resilience through adaptation. Three speakers in this session included experts from the universities and a local farmer.



### CLIMATE CHANGE AND AGRICULTURE: HOW SMALL-SCALE FARMERS IN NEW ENGLAND ARE INTERPRETING AND REACTING TO ENVIRONMENTAL CHANGES

*Maggie Ng, Hampshire College*

The first speaker, Maggie Ng, reiterated that predicted changes in climate have implications for farming activities in the region. Her presentation was on how farmers in New England are perceiving and reacting to climate change. Her talk brought out the importance of understanding the long-term effects of climate on natural and agricultural ecosystems that are vital to the region's cultural resources and wellbeing.



### SENSING STRATEGIES AND SOFTWARE TOOLS TO HELP FARMERS ADAPT TO CLIMATE CHANGE

*John Lea-Cox, University of Maryland*

The second speaker, John Lea-Cox, presented on sensor technology and software tools that can help farmers make more rational, economic decisions about their everyday practices and production. John also elaborated on how, with cost-effective equipment and strategies, farmers can reduce the impacts of climate change (e.g. helping use water efficiently).



### HOW SENSORS AND WEATHER INFORMATION HELP US TO ADAPT TO CLIMATE CHANGE AND WEATHER EXTREMES

*Pam Mount, Farmer, Terhune Orchards, Lawrence, NJ*

Pam Mount, a Farmer from Terhune Orchards, talked about how weather information has helped the sustainable production activities at her farm. She founded "Sustainable Lawrence," which is an organization that plays a role in the process of bringing together local nonprofit, civic organizations, business, school and government leaders to work towards sustainable agriculture production.

Take home messages of this session:

- > Utilizing long term climate data can help agricultural communities make decisions.
- > Sensor technology and software tools can help farmers make more rational, economic decisions about their everyday practices and production.
- > Inclusiveness of leaders from local nonprofits, civic organizations, business, schools and government is needed to work towards sustainable agriculture production.

## ADAPTATIONS TO CLIMATE CHANGE IN FORESTS

*Facilitated by Bill Buffum, University of Rhode Island and Lindsey Rustad, U.S. Forest Service*

There is increasing evidence for climate change, and forest management may not be able to keep up with these novel weather changes.

Climate change can be detected by stresses exhibited through decreased productivity, decreased regeneration, increased susceptibility to pests and pathogens, increased mortality, and increased competition from other species.



### ADAPTIVE SILVICULTURE IN THE NORTHEAST

*Lindsey Rustad, U.S. Forest Service*

Lindsey Rustad, from U.S. Forest Service, elaborated on the on-the-ground forest adaptation research being carried out by experts, managers, and regional scientists in the Adaptive Silviculture for Climate Change project. The multi-regional study with locally suited climate change adaptation treatments will help develop adaptation strategies in forest management. The five sites around the nation are having workshops to discuss the trends and impacts of the project.



### WHY SILVOPASTURING RANKS IN THE TOP TEN SOLUTIONS FOR CLIMATE CHANGE

*Brett Chedzoy, Cornell Cooperative Extension of Schuyler County*

Brett Chedzoy, of Cornell Cooperative Extension shed light on silvopasturing as a front-line approach and solution to climate change impacts. Silvopasture is the process of growing trees and forage at the same location. There are several different methods for managing silvopasture, but a preferred method is to rotate the livestock on a regular basis. Climate change is impacting animal health, and therefore using a silvopasture approach can help control animal comfort by providing shade and reducing heat stress on grazing animals. Silvopasture provides additional income from woodland areas and engages landowners to be better stewards. Using silvopasture also helps rehabilitate degraded woodland areas thus helping to reduce the impact of climate change on some farmers. More information can be found on [www.silvopasture.org](http://www.silvopasture.org).

Take home message of this session:

- This session provided a good overview on the future of the Northeast forests and how to sustain the forests. Finding sustainable methods to rehabilitate degraded woodlands and forest while also preserving lands and trees susceptible to climate change requires continuous monitoring and maintenance.

## WEATHERING WATER EXTREMES - STRATEGIES FOR ADAPTATION

*Facilitated by Lisa Graichen, University of New Hampshire and Anthony Buda, USDA Agricultural Research Service*

This session provided an overview on best farm management practices and climate adaptation strategies for extreme weather events.

Heavy precipitation and drought both create many challenges for farmers. Some adaptation measures include: rerouting laneways to reduce erosion, switching to no-till operation if growing feed (i.e. hay), adding gutters to reduce erosion around barns, and strategically targeting tilling on property. Drought requires a combination of practices such crop rotation, crop diversity, irrigation (for vegetables), water storage (stockpile water/put in a well), no-till methods with cover crops, and use of runoff water for watering animals. Changing the harvest timing can be possible if farms use a diversified cropping system, invest in larger equipment and/or improve reliability of equipment, and are ready to take advantage of weather windows.



### HOW TO INCREASE CROP RESILIENCY IN CLIMATE EXTREMES

*Kaitlin Farbotnik, USDA Natural Resources Conservation Service - New Jersey*

Kaitlin Farbotnik discussed examples of farmer experiences through her work at USDA NRCS. She recounted some examples of cover crop experiences that had helped with drainage and water retention for vegetable crops. Every 1% increase in organic matter results in as much as 25,000 gallons of available soil water per acre. Many of the farmers that she has worked with use cover crops as an additional crop rather than through a crop rotation plan. Kaitlin also mentioned that some no-till operations had increased bulk density in their soil and had reduced erosion. There are many services/programs provided by NRCS that can help farmers reduce the impact of climate change on their properties. NRCS programs are geared to help farmers create an on-farm profit. Often, early adopters help show other farmers how it's done. However, a major gap is the need for sharing demonstrations of effective practices.



### DIAGNOSTIC DECISION SUPPORT AND BMP EFFECTIVENESS FOR WATER QUALITY GAINS

*Hubert Montas, University of Maryland*

Hubert Montas from University of Maryland focused his presentation on the changing rainfall patterns (in volume and intensity) projected for the future. University of Maryland researchers are monitoring increased runoff, sediment, nitrogen and phosphorus, but it is difficult to predict what will happen in the future. Some Best Management Practices (BMP) need to be in place in order to help reduce runoff in the future. However, at the same time, more resources need to be developed to more effectively reduce nutrient runoff on Maryland farms. More monitoring of the increasing amounts of sediment, nitrogen and phosphorus in hot spot regions is needed. More test models need to be developed across the Northeast region to fill these research gaps. Similarly, it is very hard to determine what the BMP will be in the future with the current, limited data, especially with such extreme weather as of late. Universities could adapt this approach to determine more data points and could further reach out to communities for help.



**ON-FARM ADAPTATIONS**

*Sarah Ficken, Farmer, New Moon Farms, Munnsville, NY*

Sarah Ficken of New Moon Farm in New York has dairy cows, vegetables and pastures. She gave a brief synopsis of her farm and the challenges she faced with the ever-changing climate. Sarah is a great example of a farmer who is paving the way through her response to extreme precipitation, drought, changing harvest windows, and a difficult economy. She emphasized the importance of data and experience sharing. Sarah also acknowledged the many programs that can help farmers save and create income on their farms.

### Take home messages of this session:

- > Data and experience sharing are one way to understand effects of climate change and how to adapt.
- > Peer-to-peer interactions are the best ways to get farmers to adapt to new practices.



*William DellaCamera, Farm Manager of Cecarelli Farms in Northford, CT, troubleshoots the farm's on-farm weather station. Photo: USDA Northeast Climate Hub*



*Dr. Becky Sideman researches nutrient management inside high tunnel systems at UNH in Durham, NH. Photo: USDA Northeast Climate Hub*

## HOW CAN WE ADAPT ON A CROP-BY-CROP BASIS?

*Facilitated by Jennifer Volk, University of Delaware  
and Michel Cavigelli, USDA Agricultural Research Service*

Since climate change is having a noticeable impact on most industries, it is no surprise that agriculture is one of the most affected industries.

Therefore, it is desirable that common industry practices are adjusted and growers utilize new practices. Consumer demands dictate what is grown, how it is grown, and how much of it is grown. A more informed consumer is the typical trend in today's market. In addition to wanting an affordable product, consumers also want to know where their food comes from, and many prefer locally grown produce from small farming systems sustaining environmental conditions, such as maintaining surrounding local forested areas and wetlands that would otherwise be developed.

Discussion focused on how farmers are already adapting to challenges. For instance, to supplement a farmer's income, many are offering agri-tourism programs and events.

Agri-tourism not only benefits the community, but it also brings a loyal customer base directly to the farms. Locally grown produce also means less large-scale shipping, historically accomplished with trucking companies, which in turn, means less fossil fuels consumed in bringing produce to the consumer's table. Consumer trends also indicate a need for more organic food options, but at an affordable cost. Sweet potatoes are a viable option for farmers who want a crop that can be managed organically, as sweet potatoes are usually only minimally damaged by insects. In other words, pesticides are typically not needed to maintain sweet potato yields.

Drought is a major concern when it comes to climate change as some planting systems, many in the Northeast, are not prepared or equipped for irrigation, making them extremely vulnerable to drought. It is therefore imperative to find crops that are drought resistant. Common bean plants (*Phaseolus vulgaris*) were used to study genetic differences to irrigated and non-irrigated plots that mimicked drought condition.





Harvested hand  
picked large sweet  
potatoes, at Kirby  
Farms in Virginia.  
USDA Photo: Lance  
Cheung

Heat stress currently reduces yields of May and early June -planted lima bean (*Phaseolus lunatus*) in the Mid-Atlantic Region of the US. High night temperatures during flowering and seed development can reduce or delay pod set, resulting in delayed harvest, lower yield, and split pod sets. Increases in night temperatures as a result of climate change are projected to be greater than daytime temperature increases, so it is important to understand how certain crops might be affected by this pattern of climate change. As researchers characterize physiological changes associated with heat sensitivity in different crops, this information is being used to screen diverse germplasm and breeding lines in order to select for heat tolerance. The University of Delaware breeding program is using this approach to select for heat tolerance in lima bean.

### Session presentations:



#### GENETIC AND EPIGENETIC RESPONSES TO ENVIRONMENTAL STRESS IN COMMON BEAN

*Issac Fisher, Delaware State University*



#### ADDRESSING LIMA BEAN YIELD LOSS TO HEAT STRESS THROUGH BREEDING

*Emmalea Ernest, University of Delaware Cooperative Extension*



#### COMPARING THE TRANSCRIPTOMES OF THREE PHENOTYPICALLY DIFFERENT SWEET POTATO CULTIVARS

*Elizabeth Fiedler, Delaware State University*



#### PERFORMANCE OF SWEET POTATO AS AN ALTERNATIVE AGRICULTURAL ENTERPRISE WHILE TRANSITIONING TO ORGANIC FARMING

*Lekha Paudel, Delaware State University*

## ADAPTATION CONSIDERATIONS FOR CLIMATE CHANGE IMPACTS IN COASTAL AREAS

*Facilitated by Marjorie Kaplan, Rutgers University and Gulnihal Ozbay, Delaware State University*

This session started with Chris Miller, from USDA–NRCS, who spoke about an adaptation strategy that has a promising application to cope against climate change.

*Spartina patens* are grown as a salt hay in high saline regions. A plant that is salt tolerant can be used to stop invasion of Phragmites in the wetland area. Growing or establishing a salt-tolerant plant like *S. patens* or Eastern Gamma grass will help restore and enhance marginal lands for ecosystem services. There is also potential for planting a bioenergy crop (switch grass; coastal panic grass; prairie cord grass) in marginal areas for on-farm energy use.

The second speaker, Jenny Shinn, from Rutgers, presented on the usage of living shorelines as an alternative shoreline protection tactic along coastal farms to reduce the impacts of sea level rise. Incorporating ecological principles into their engineering and design, living shoreline projects aim to stem erosion that can lead to rapid loss of the marsh surface bringing saltwater back to farms and forests. By reducing wave energy, the installation of a living shoreline can accelerate sediment accretion and promote vegetation growth to assist the marsh in keeping pace with rising seas and thus reduce flooding.

From Delaware State University, Gulnihal Ozbay spoke on oyster populations which have decreased by more than 95% due to diseases and over-harvesting. As a keystone species in the Mid-Atlantic estuaries, Eastern oyster populations are struggling to rebound to sustainable numbers. Agriculture and sedimentation are the major contributors of pollution in Delaware Inland Bays. The pollution threatens population density and oyster survival. Current oyster populations are not sufficient to make impacts on the water quality and ecosystem roles we expect them to provide. There is potential to better manage the ecosystem health of the Delaware Inland Bays through large-scale aquaculture operations. Oyster reefs can be used for erosion control. There are some initial costs, but the potential economic gains of oyster aquaculture may outweigh the costs when you include ecosystem services. Promoting oyster aquaculture in Delaware Inland Bays to remove nutrients and improve water clarity will enhance the natural spat population and further oyster growth. Further investigation on water quality and aquaculture techniques will ensure the successful outcome of this long-term program.

### Session presentations:



#### SELECTION AND USE OF CONSERVATION PLANTS TO AMELIORATE THE IMPACTS OF SALTWATER INUNDATION ON CROPLAND

*Chris Miller, USDA Natural Resources Conservation Service*



#### LIVING SHORELINES AS A POTENTIAL METHOD TO REDUCE IMPACTS OF SEA LEVEL RISE ON COASTAL FARMS

*Jenny Shinn, Rutgers University*





## EFFORTS TO MITIGATE CLIMATE CHANGE REPERCUSSIONS ON OYSTER POPULATIONS AND NATURAL OYSTER RECRUITMENT VIA AQUACULTURE PRACTICES IN DELAWARE

Gulni Ozbay, Delaware State University

Important take home messages of this session:

- > Damaged farmland and its economic value can be restored by planting salt tolerant crop varieties that have diversified uses.
- > The economic impacts of habitat changes and related mitigation/restoration practices are complex and hard to calculate. For example, there is a high demand for salt meadow cord grass for various purposes like cattle feed and litter boxes, but supply is limited.
- > Living shorelines are a tactic that may be a solution to reduce saltwater intrusion into agricultural and residential areas. They incorporate natural features and construction materials to reduce erosion and create habitat.
- > Some of the research gaps discussed in this session include how to use plant varieties to adapt to changes. Different varieties may respond differently to the *Phragmites* invasion and have different abilities to restore habitat function. Shorelines with combinations of enhanced plants such as *Spartina alterniflora*, and oysters *Crassostrea virginica*, are effective for decreasing wave energy, erosion control, and sediment accretion rate.



Capt. Tyrone Meredith harvests oysters with a hand tong near Broad Creek, a tributary of the Choptank River in Talbot County, Maryland in February, 2018.  
Photo: Will Parson, Chesapeake Bay Program

## PLANTS AND SOILS

*Facilitated by Michel Cavigelli, USDA Agricultural Research Service and Kathy Bunting-Howarth, Cornell University*

This session was about agricultural practices including crop and soil management.

We can see the impact of changing climate on agriculture and pastures. Some of the main issues facing vegetable growers in the Northeast include the following: 1) excessive rain and atmospheric moisture will hinder the quality of fruits and vegetables and alter the quality of cultivated soils, 2) unpredictable weather and warmer fall seasons change farm operation schedules, and, 3) the appearance of weeds in pastures, which were not problematic in the past are causing production problems and encourage use of more pesticides.

Adapting with new methods and practices will help mitigate losses or impacts. Various methods and practices are available and can be adopted by farmers. The suggested/observed adaptation strategies discussed in this session included the following: 1) Use of high tunnels to grow vegetables, and soft and stone fruits, 2) Use of parthenocarp varieties where there are low/no pollinators in high tunnels, 3) Use of cover crops, better tillage management practices, and periodic monitoring of soil health as coping mechanisms, and, 4) Use of biochar compost, wood chips and chips as mulch in the soil for enhancing soil productivity and carbon sequestration.

The primary focus of this session was on how farmers can prepare their farms to adapt to changes in the climate. Strategies to sustain farm profit and viability were discussed. Continued education and communication are the key to help our farmers adapt to the changing climate and sustain their farm living.

### Session presentations:



#### HIGH TUNNEL VEGETABLE TRIALS

*John Bombardiere, West Virginia State University Extension Institute*



#### A CITIZEN- SCIENCE MODEL TO BUILD SOIL HEALTH AND ADAPT TO CHANGING CLIMATES

*Franklin Egan, PA Association for Sustainable Agriculture*



#### DETERMINATION OF GROWING DEGREE DAYS TO MANAGE A WARM SEASON ANNUAL WEED IN A COOL SEASON PASTURE

*Rakesh Chandran, West Virginia University*



#### OBSERVING CHANGES AND MITIGATING THEIR IMPACTS TO PLANTS AND SOILS IN CENTRAL NEW JERSEY

*Jim Kinsel, Farmer, Honey Brook Organic Farm, Pennington, NJ*

## DAIRY AND LIVESTOCK

Facilitated by Curtis Dell, USDA Agricultural Research Service and Lisa Graichen, University of New Hampshire

### Session presentations:



#### CLIMATE CHANGE ADAPTATION STRATEGIES FOR DAIRY CROPPING SYSTEMS

Heather Karsten, Pennsylvania State University

Heather Karsten of Pennsylvania State University focused on the benefits of manure injection versus the conventional application of manure to eliminate runoff. Manure injection reduces application and costs of applying nutrients, improves water health and quality/nutrition of livestock feed crops, and increases soil health. She also discussed that best practices with manure application along with integrated pest management (IPM) principles can reduce the impact on the environment and save money. There are gaps in considering all options in terms of manure application, which is not limited to just the application costs of the manure, but also the health and quality of the surrounding environments. Current research and data suggest that manure injection is a much less environmentally taxing strategy of nutrient application than conventional methods. More research and awareness are needed in terms of farmers who are using manure on their farms. Employing the suggested agricultural practices as discussed appears to be an all-around winning scenario. Using the injection practice saves farmers money by: 1) reducing the waste of nutrients that run-off due to rain, 2) increasing soil health, 3) increasing nutritional value of livestock feed crops, and 4) maintaining water quality. IPM principles provide similar benefits.



#### BIOGAS SYSTEMS, CARBON SEQUESTRATION AND DAIRY FARM VIABILITY

Alex DePillis, VT Agency of Agriculture

Alex DePillis, an Agricultural Development Coordinator for the state of Vermont, reiterated that the largest percentage of agricultural sales in his state are from dairy. Dairy contributes to total greenhouse gases via methane. Diet tweaking can influence changes in manure, dairy, and methane production. Other GHG reduction strategies include mitigation, adaptation, and digesters. Mitigation includes biochar (burning methane into carbon dioxide) and sequestration into the soil. Digesters can separate liquids from solids (this was also highlighted in Jenifer Wightman's talk). Farms all have different landscapes, weather and climate, and specific requirements, and so every farm will require different strategies. A research gap exists for hard numbers in terms of exact dollar amounts to convince farmers to use some of these strategies.



#### DAIRY MANURE STORAGE AND GREENHOUSE GAS MITIGATION AND ADAPTATION OPPORTUNITIES

Jenifer Wightman, Cornell University

Jenifer Wightman of Cornell highlighted her work on sustainable bioenergy production and greenhouse gas inventories of forestry and agricultural systems. The focus of her talk was on greenhouse gas mitigation and comparing the pros and cons of using "covering and flaring systems" for manure storage and increasing feed conversion. Jenifer's top four practices were to: 1) farm in forests, 2) reduce methane, 3) reduce waste, and 4) use best management practices. There is a tradeoff between water quality and greenhouse gas emissions. Because anaerobic respiration happens in enclosed →

storage environments, more methane than carbon dioxide is produced. However, because it is enclosed it does not affect the local water quality. A gap in technology is to discover a win-win scenario. There is a research need to destroy production of methane by conversion to carbon dioxide. Gains for farmers are estimated by saving money by increasing feed conversion. To do this, proper feeding can increase the conversion of feed; thus, reducing the amount necessary. Additionally, using covers on manure storage systems can reduce the water content. Since manure is sometimes disposed of by weight, eliminating water will reduce the cost of disposal. Environmental quality is also increased due to reducing waste and manure runoff.



### RAISING GRASS-FED BEEF IN A CHANGING CLIMATE

*Lucia Huebner, Farmer, Beech Tree Farm, Hopewell, NJ*

Lucia Huebner raises grass-fed beef and lamb on her farm, Beech Tree Farm, in New Jersey. Meat derived from grass-fed cattle is more nutrient-dense and lower in cholesterol than grain-fed cattle. While grass-fed cattle generate more methane, their manure effects on soil compensate for this and contribute less to overall greenhouse gas emission. The challenge is to adapt to weather unpredictability, and determine what the best grasses/trees to plant for successful farming. For Lucia, the best grasses specific to the region/climate should be chosen for raising grass-fed livestock. There are economic gains of dealing with unpredictable weather by using adaptation strategies. Direct farmer-to-farmer interactions are the most efficient way to communicate this information. Lucia suggested that building a community, networking, and encouraging regenerative farming was the ideal way to communicate with other farmers and members of the community.



*Dairy cattle at Brubaker Farms in Lancaster County, Pennsylvania  
Photo by Will Parson, Chesapeake Bay Program*



## FRUITS AND VINES

*Facilitated by Rachel Schattman, USDA Northeast Climate Hub, and Marjorie Kaplan, Rutgers University*

### Session presentations:



#### **AUTOMATED ACCESS TO FREE NOAA HOURLY WEATHER FORECAST AND WEATHER DATABASES AS INPUT INTO AGRICULTURAL DECISION SUPPORT MODELS**

*Glen Koehler, University of Maine*

Glen Koehler of University of Maine focused his presentation on using weather-based technology to help farmers with timing of IPM practices. NOAA has a Virtual Lab that can help better use weather forecasts. There is increasing use of weather sensors being used in agriculture, however there is a lack of actual accurate projections available for weather conditions. The more accurate weather predictions are, the better chance farmers have to combat issues that could arise. From the economic standpoint, if farmers have accurate weather projections, they will have the ability to perform IPM practices with more precision, such as spraying fungicides. Farmers without this knowledge will have less chance of protecting their plants, and an increased chance of yield reduction. Therefore, the use of outreach programs such as NOAA's Virtual Lab could be very beneficial for all farmers, but there may be a learning curve that would need to be overcome. Extension centers could give presentations on the topic to inform the public to what programs are available and how they are used.



#### **HOW A FAMILY FARMER IS RAISING TREE FRUITS, BERRIES, AND GRAPES IN A CHANGING CLIMATE**

*Pam Mount, Farmer, Terhune Orchards, Lawrence, NJ*

Pam Mount, Farmer of Terhune Orchards, Lawrence, NJ addressed a gap on how an operating farm can combat and adapt to climate change. She shared her experiences growing vegetables, fruits, ornamental plants, and herbs to sell and continuously enhance the farm and its services. For instance, they do more than growing fruits and vegetables, they host festivals, U-pick operations, classes, and wine tastings. She discussed a few climate adaptation practices, such as new crops/cultivars suited for the changing growing seasons, and an increased use of hoop houses or row covers. However, farmers need more practical approaches to defend against extreme weather conditions such as floods, drought, and increased heat. From Pam's economic standpoint, farmers could lose an entire crop due to harsh weather conditions, while combatting the climate issue could help save some of that crop's yield. The economic losses/gains would all depend on the farm itself, in regard to what they grow and the measures they take in order to become more climate resilient. Pam provides outreach to her community by giving classes on different topics at her own farm. This platform could be extended to any working farm that is willing to welcome the public to their business for classes.



#### **STRATEGIES AND TACTICS FOR WINE GRAPE PRODUCTION IN A CHANGING ENVIRONMENT**

*Dan Ward, Rutgers University and New Jersey Agricultural Experiment Station*

Dan Ward of Rutgers University and the New Jersey Agricultural Experiment Station presented on grape growing within New Jersey. He discussed methods of combating climate change such as trying new cultivars in new locations and altering cultural methods. It is not known how growing degree days will change in the area, but this will be a very important factor for planting new cultivars. A cultivar →



that can tolerate extreme conditions while still yielding an acceptable harvest will be needed as environmental conditions worsen. One major gap is that farmers are still either not convinced about the realities of a changing climate and/or they are unsure of how climate change will directly affect them. So, many farmers are not taking actions that could help combat climate change on their farms. Increased cultural practices that can help combat climate change need to be identified and communicated to farmers. From the economic standpoint, depending on the severity of climate conditions, complete harvests can be lost, or worse, the vines themselves could be destroyed.



### VARIETY EVALUATIONS AND STRESS MITIGATION STRATEGIES FOR SMALL FRUIT CROPS IN A CHANGING CLIMATE

*Gordon Johnson, University of Delaware*

Gordon Johnson focused on how farmers can combat climate change in Delaware. He discussed topics such as: heat tolerance in strawberries and blackberries; mitigating heat via different mulches; and growing hybrid grapes and highbush blueberries. As extreme weather conditions become more prevalent, farmers will need a better understanding of how climate change will affect their operation and the things they can do to help protect their farm. He also discussed how farmers will need new varieties that have improved tolerance to worsening weather conditions. Farmers will also need new cultural practices for growing crops to help them adapt their farm to changing conditions. In terms of economic cost, an extreme weather event could wipe out an entire farm's harvest. Attempting new cultivars can be an economically feasible way to mitigate damages from extreme weather and bring economic gain to farms. New cultivar information could easily be passed on to local farmers via presentations by their local extension agents (which they are currently doing), and through both physical and digital pamphlets.

Important take home messages of this session:

- As extreme weather conditions become more prevalent, farmers will need a better understanding of how climate change will affect their operation and the things they can do to protect their farm.
- Prevention methods can be used to lessen the blow, but it is up to the farmer to assess their own situation and decide.
- There is need for improvement in accuracy of weather predictions to allow farmers more precision in preemptive actions to protect their crops.



An aerial photograph showing a living shoreline installation in a marshy area. In the foreground, a group of workers are standing on a wooden walkway, surrounded by numerous large, grey, rectangular concrete blocks arranged in a grid-like pattern. The blocks are partially submerged in the water. The background shows a vast, flat, green marshy landscape with some small pools of water and distant trees.

**DAY 2**  
MARCH 15, 2018

*The first phase of the Hurricane Sandy-funded living shoreline installation in Downe Township, New Jersey, part of the Gandy's Beach shoreline protection project, was completed in October 2015. Photo: Damon Noe, The Nature Conservancy*



# USDA NORTHEAST CLIMATE HUB PARTNERS

## NORTHEAST HUB PARTNERS

*Erin Lane, USDA Northeast Climate Hub*

The USDA Northeast Climate Hub is a collaboration of USDA and other partners. The NE Hub relies heavily on our land grant partners- both in research and extension. We aim to share information and highlight successes in order to reach our overall goal of helping our stakeholders deal with the changing climate. We have worked together on an innovative demonstration project to bring forward some of the work happening at each of our partner Universities. A diverse planning team tackled the task of pulling together the vision and details to make this partners meeting a reality. Consider encouraging your graduate students to join GradCAP- a graduate student forum focused on climate adaptation for scholarly discussion and growth.



## CLIMATE LEARNING NETWORK RESOURCES, COLLABORATION, AND CLIMATE LITERACY CERTIFICATION

*Dan Geller, Climate Learning Network*

The Climate Learning Network is part of eXtension which supports the Cooperative Extension Program at our land grants. Their focus is on training Extension professionals with regard to Issues, Impact, and Innovation. They have a number of climate- specific resources available including e-learning modules, webinars, and newsletters. The Climate Literacy Certification program features competency development and customized training specific for extension professionals.



*Lynn Knight, USDA Northeast Climate Hub Co-Director and Suzy Hodgson, University of Vermont Extension collaborate at Borderview Farm in Alburg, Vermont on an economic case study on milkweed as an alternative crop. Photo: USDA Northeast Climate Hub*



## INTERACTIVE OUTREACH TALKS

Through five-minute project pitches, presenters moved from room to room to share adaptation practices, outreach methods, and projects associated with the USDA Northeast Climate Hub partnership.

Participants acted as outreach specialists or producers (or users of the outputs of these projects) to interact with presenters. There were five blocks of presentations, each 18 minutes long and containing two project pitches (up to 5 minutes each), followed by a short discussion session.

### ADAPTING FARMS TO WEATHER EXTREMES AND CLIMATE UNCERTAINTY

*Dan Dostie, USDA Natural Resources Conservation Service - Pennsylvania*

Dan introduced the Adaptation Workbook, a good resource for agriculture producers. He suggested the most important chapter is chapter two (Principals of Adaptation) and its seven principles:

- Set priorities for most vulnerable site or operation
- Take precautionary actions
- Be flexible and open-minded to transformative change when little changes are no longer adequate
- Monitor and continuously learn
- Look toward the low hanging fruit for no regrets and co-benefits
- Think long range while taking short range steps
- Seek stewardship opportunities

Growers should seek to understand the costs of adaptive practices, and ask: where do I need to be 2 or 5 years from today?

### TOOLS FOR TRIBAL OUTREACH

*Suzanne Baker, USDA Natural Resources Conservation Service*

Suzanne was a Liaison to the USDA Northeast Climate Hub in 2017. She talked about Tribal concerns in her region. There is a concern for declining species that have nutritional, cultural and spiritual significance. A new effort aims to incorporate about 30 weather station units nationally to support the agriculture and climate education needs of Tribes. Some of their climate concerns included: sea level rise, food sovereignty, use of alternative crops, and sweet grass decline.

### 'AS IF YOU WERE THERE' VIRTUAL CLIMATE ADAPTATION DEMONSTRATIONS

*Jennifer Volk, University of Delaware and Karrah Kwasnik, USDA Northeast Climate Hub + University of New Hampshire*

University of Delaware is working with the USDA Northeast Climate Hub on the development of a virtual network of field demonstration sites. Using innovative techniques including 360 degree photography and video interviews, the producers bring you to the site and show you around. The team shares their online tours which provide a variety of informational and educational resources and techniques used at each site. This outreach method showcases the ways farmers and forest managers are adapting to a changing climate.

## **GARDENING IN A WARMING WORLD: STRATEGIES FOR ENGAGING GARDENERS AND COOPERATIVE EXTENSION MASTER GARDENER VOLUNTEERS**

*Lori Brewer and Anne Christian-Reuter, Cornell University*

Food systems are often the center of a healthy community and the prime connector among the people. This program focuses on establishing Food HUBs in urban settings for healthy food sources and healthy living, while also providing education and training. Opportunities such as aquaponics or urban community gardens can make the difference in the health and well-being of an urban community. People often have an understanding on how climate change impacts natural resources and/or how natural resources affect peoples' well-being, but they often have little knowledge on how climate change affects them directly. Gardeners have seen increased pests, disease, flooding, and drought. Gardeners are a great audience to document experience with change. "Gardening in a Warming World" is incorporated into the Master Gardener Volunteers guide in New York.

## **OUTREACH AND ECONOMICS: FROM VIDEOS TO CASE STUDIES – FRAMING AND ANALYZING THE COSTS AND BENEFITS OF HOW FARMERS ARE ADAPTING TO CLIMATE CHANGE**

*Suzy Hodgson, University of Vermont Extension*

To communicate good practice of farms adapting to climate change, it's important to have farmers describing in their own words how they are experiencing the climate and how severe weather is impacting their farms. This sets the context for adaptation case studies about farmers' direct experiences. Two adaptation practices were examined more closely: irrigation and gully repair. For these two case studies, we interviewed the farmers and collected primary data including costs and benefits of specific practices from the farmer as well as secondary data from published sources. We assessed the data over a 15-year time horizon. A starting question for the irrigation study was, "does crop irrigation make sense as a climate adaptation strategy given the overall increased precipitation trend in the Northeast"? The key findings answered this question: whether a year is on average "wet" or "dry", we discovered that the benefits of avoided crop loss at Intervale Community Farm in Burlington were greater than the costs of irrigation. This is because even in "wet" years, rainfall does not always coincide with crop production needs. Looking at the numbers another way, if the farm can protect at least 3.5% of its crop revenues with irrigation, it will cover its costs of irrigation. Two approaches to gully repair at Last Resort Farm in Monkton, VT were compared and assessed over the 15-year project time horizon. The water quality benefits of reduced sedimentation from gully stabilization in addition to the direct farmer benefits from less soil erosion more than covered the costs of gully repair. This case study showed that when farmers are deciding on adaptation practices with wider public benefits, funding support from NRCS can help make sure the project is financially viable. These case studies provided a good model for assessing the true value of climate adaptation practices for farmers in the Northeast.

## **TOOLS TO SIMPLIFY CLIMATE ADAPTATION**

*Sarah Wiener, USDA Southeast Climate Hub*

This program focuses on using existing resources (via NRCS web sources) to prepare educational and training tools that are in simple formats for people to better understand. There is no need to duplicate efforts. Information and resources available via Southeast Climate Hub, Northeast Climate Hub, NRCS, university partners and many others are adaptable and presented in simple, easy to digest ways for the public.



## BRIDGING THE CLIMATE INFORMATION USABILITY GAP: ENGAGING FARMER NETWORKS AND BOUNDARY ORGANIZATIONS

*Alissa White, University of Vermont*

This research focuses on how to develop outreach materials for farmers. Researchers are discovering what information farmers need, what information is most useful, and how/where farmers access information. For instance, information on extreme weather impacts is very useful to the farmers. It is good to know what other farmers do and under what conditions and circumstances. Content-specific information on exact needs will be useful to the farmer. What plans do the farmers have in place if something happens, extreme weather events...etc.? What are the costs of applying those plans? Researchers are developing a survey to learn about the issues and needs of farmers. The results will help the outreach education staff bring something valuable and useful to farmers.

## CLIMATE CHANGE AND AGRICULTURE IN NEW YORK AND PENNSYLVANIA: RISK PERCEPTIONS, VULNERABILITY AND ADAPTATION AMONG FARMERS

*David Lane, Cornell University*

Results from newly published research focused on how farmers perceive climate impacts on their farms. They have witnessed the following climate-related concerns: soil erosion, wet fields, and flooding due to increasing heavy downpours, and shifting seasons, drought, and increased pest pressure. With profit margins already tight, these impacts could affect farm viability. What practices are they willing to adopt on their farms? This varied by commodity type, but included: cover crops, no-till methods, water management, crop rotations, and nutrient management. How do perceived risks and vulnerabilities affect farmers' decision-making related to adaptation and mitigation strategies? They were more likely to take action if they perceived it would financially benefit them. Many farmers from these focus groups articulated concern regarding climate impacts, but they also expressed skepticism towards human-caused climate change. Through these focus groups, it became clear that other business pressures such as profitability, market conditions, labor availability, and government regulations often out-weighed climate change concerns in their decision-making.

## WATER ACCESSIBILITY FOR COMMERCIAL VEGETABLE FARMS IN THE NORTHEAST

*Rachel Schattman, USDA Northeast Climate Hub + University of Vermont*

There is currently no research on how farmers use water in the Northeast. If we don't know what people are doing, we can't help them. This outreach program focuses on irrigation issues, adaptation strategies, and quality of post-harvesting washing water. Developing a guideline for post-harvesting wash is important and currently there is no existing guide on post-harvesting vegetable washing water quality. Water use efficiency is something to consider and factor in to the guidelines. Dr. Schattman summarized the results of her survey with vegetable producers looking at water use practices. Over 150 responses showed that folks are overwhelmingly irrigating, and drawing from a variety of water sources. From a food safety perspective, it would be useful to know where water is coming from, and its quality. Results of the survey include:

- There are no industry standards on how to wash produce
- There is a need for FISMA information – new food safety guidance
- Farmers use crop conditions to know when to irrigate, but that is likely too late
- Soil moisture sensors would help, but may still be inadequate
- There are needs for other indices such as a cattle comfort index

## **CLIMATE MASTERS PROJECT: A FARMERS FELLOWS PROJECT FOR PEER-TO-PEER CLIMATE ADAPTATION EDUCATION**

*Hannah Aitken and Joshua Faulkner, University of Vermont*

Food systems are often the center of a healthy community and the prime connector among community members. This outreach program focuses on leveraging natural leadership of forward-thinking farmers and foresters. It addresses developing a curriculum for the region to harness peer education. The project includes Literature Reviews, Curriculum Design, and Impact Assessment. Four major sectors were targeted in this program: vegetables/ small fruits, dairy, tree fruit, and forests. Some incentives, compensation or resources are planned for the first fellows so they can lead and bring in more farmers.

## **NIFA CLIMATE MASTER'S PROGRAM**

*Kathy Bunting-Howarth and Allison Chatrchyan, Cornell University and Sara Via, University of Maryland*

This program focuses on developing a climate master program. It is designed to offer training to volunteers who serve in communities. Providing training and establishing core/key and local volunteers will ensure the success of the program, and its ability to reach out to communities at-large. Focus groups were administered to understand the needs and gaps, and to measure the feasibility of such training and community engagement. There are many steps involved in offering a program to the community: develop a plan, use existing curriculum, obtain data on various issues (storm water versus salt water intrusion), develop a curriculum based on specific community needs, and gear the contents of the curricula to the issues in the community or new, emerging issues.

## **KEY INFLUENCES TO FARMERS' CLIMATE CHANGE FARM MANAGEMENT DECISIONS: A PENNSYLVANIA STUDY**

*Kaila Thorn, Pennsylvania State University*

A focus group is one way to talk directly to, and collect information from, farmers. Focus groups are also efficient and provide detailed information/answers on topics discussed. This type of group meeting also helps extension staff connect the farmers and exchange information. Some of the adaptation strategies used on one farm can be adapted for others. There is a lot of information available out there, but what information is most trustworthy and accurate? This study in Pennsylvania focused on conducting a survey to understand: a) Who are the stakeholders? b) What do PA farmers think of climate change? c) Who influence the farmers? d) How do we get to know the needs of farmers/ participants?



# DEVELOPING A COMMUNITY OF PRACTICE: PART 1

*Facilitated by Erin Lane, USDA Northeast Climate Hub*

This presentation was about a new model for building collaborations.

The focus of the talk was on a workshop held in October of 2017. The goal and purpose for the workshop was to lay groundwork for this concept of sharing across the US/Canadian border. The three themes for the workshop were described as: a) extreme weather, b) pests, and c) decision support. A Tools Café platform was held to support theme three. For example AgWeather Quebec and AgWeather Atlantic are weather-based tools that provide support to farmers and other stakeholders. The focus was on opportunities to share tools and information across borders. Discussions around each theme at the workshop led to the identification of possible collaborative projects. The session ended with a call for collaborations and the presenters invited this audience to join. A sign-up sheet for each identified discipline was available at the side of the conference area.



## **A NEW MODEL FOR BUILDING COLLABORATIONS: WHAT DID WE LEARN FROM THE 2017 U.S. - CANADA CLIMATE CHANGE SYRACUSE WORKSHOP?**

*Mike Hoffman, Cornell University and Larry Lenton, Agriculture and Agri-Foods Canada*



*Aerial view of Highmoor Farm, a University of Maine research facility specializing in apple, small fruit, and vegetables, and a Maine Agricultural and Forest Experiment Station. Photo: David Hollinger - used with permission*

## DEVELOPING A COMMUNITY OF PRACTICE: PART 2

*Facilitated by Marjorie Kaplan, Rutgers University*

Community of Practice basics were presented along with a draft vision statement for a USDA Northeast Hub CoP and a series of questions for breakout session participants to consider.

Anthony Buda (USDA Northeast Climate Hub), Curtis Dell (USDA Northeast Climate Hub), Lisa Graichen (University of New Hampshire Cooperative Extension and Sea Grant), Marjorie Kaplan (Rutgers University) and Erin Lane (USDA Northeast Climate Hub) led a facilitated session to take steps to formalize a Community of Practice (CoP) around agriculture and forestry in the Northeast as a model to most effectively continue the conversations begun through the partners meeting. A report-out of groups was facilitated by the session leaders.

### NORTHEAST CLIMATE ADAPTATION IN AGRICULTURE COP VISION STATEMENT PITCHED FOR DISCUSSION:

The Northeast Climate Adaptation in Agriculture and Forestry Community of Practice (CoP) brings together individuals and networks from governments, academia, non-profit organizations, and the private sector with a common interest in climate change and its relationship to rural and urban communities, tribes, agriculture, and forestry. Specifically, the CoP seeks to: a) apply climate science to assess how climate variability and change is affecting the management of agricultural and forested ecosystems in the Northeast region, b) share lessons learned and develop best practices that enable stakeholders in agriculture and forestry to adapt to and mitigate the effects of climate variability and change in the Northeast region, and, c) leverage extension, outreach, and communication tools to provide education, research, and networking opportunities to CoP members that advance knowledge and awareness of climate science, climate impacts, and adaptation strategies in agriculture and forestry.

Each group discussed questions addressing potential roles of a CoP, challenges that might benefit from working through a CoP; specific areas or hot topics of interest which could benefit by sharing best practices and lessons learned; goals of this CoP and modifications to the draft vision statement; and suggestions for how the CoP should operate.

### POTENTIAL ROLE OF A COMMUNITY OF PRACTICE

- Exchange knowledge of pest presence
- Promote community, increase involvement and participation, improve understanding of who's involved with climate and ag in this region and what resources are available
- Keep current about advances and new understanding in climate change science
- Share successful and unsuccessful approaches, and where to find resources
- Improve access to tools, data, resources; increase sharing between regions; avoid duplication of effort
- Provide information to producers/Extension agents; serve as a clearinghouse to better concentrate resources towards the needs

## CHALLENGES/INFORMATION NEEDS THAT A COMMUNITY OF PRACTICE COULD ADDRESS

- Communication
- Translating climate change information into plain language
- Translating new science into messages for a broad audience without being alarmist
- Translating new science into actionable items for farmers
- Making mitigation compelling
- Building a neutral network from the bottom up
- Helping people adopt long-range thinking while addressing short-range problems
- Translating terms to more accessible ones, communicating about risks
- Assisting rural communities as a whole (ag and/or forestry and other components)
- Increasing communication between researcher, extension, and practitioner
- Increasing communication between farmers – moderate, facilitate
- Tracking what producers are doing – what practices are they trying; align research
- Motivating landowners to participate in forestry adaptation practices
- Identifying what forest products producers need
- Better packaging of educational and extension materials
- Finding sustainable funding
- Integration/funding of decision aids that are widely useful/generally applicable

## HOT TOPICS FOR A COMMUNITY OF PRACTICE

- Vulnerability assessments on fruits, veggies, dairy
- Economics, risks, cost/benefit of adaptation practices
- Short- and long-term precipitation forecasting, how to deal with too much/not enough
- Updated projections for culvert size given increased rainfall and forest cover projections
- Seasonal forecasts
- Non-ag rural community needs; urban agriculture issues
- Dealing with new pests and weeds
- There's lots of general advice out there, but we need more specifics - i.e., what varieties work for different soils; details at regional and smaller level; local demonstrations
- Regionally specific practices (e.g., what cover crop species work in the area and effective management (planting dates, species for specific functions, etc.)
- Choice of crop varieties that are tolerant to climate change impacts
- Soil health
- Coastal erosion and sea-level rise
- Irrigation and sensor technology specs and usefulness for different conditions
- Connecting dots between programs (e.g., NRCS) and these issues, publicizing available programs, connecting to best practices
- How farmers view/use particular tools and resources
- How farmers can use funding sources (e.g., carbon tax/credit, innovative funding, RGGI revenue); learn from others (e.g., MD cover crop fund)



## POTENTIAL COMMUNITY OF PRACTICE GOALS

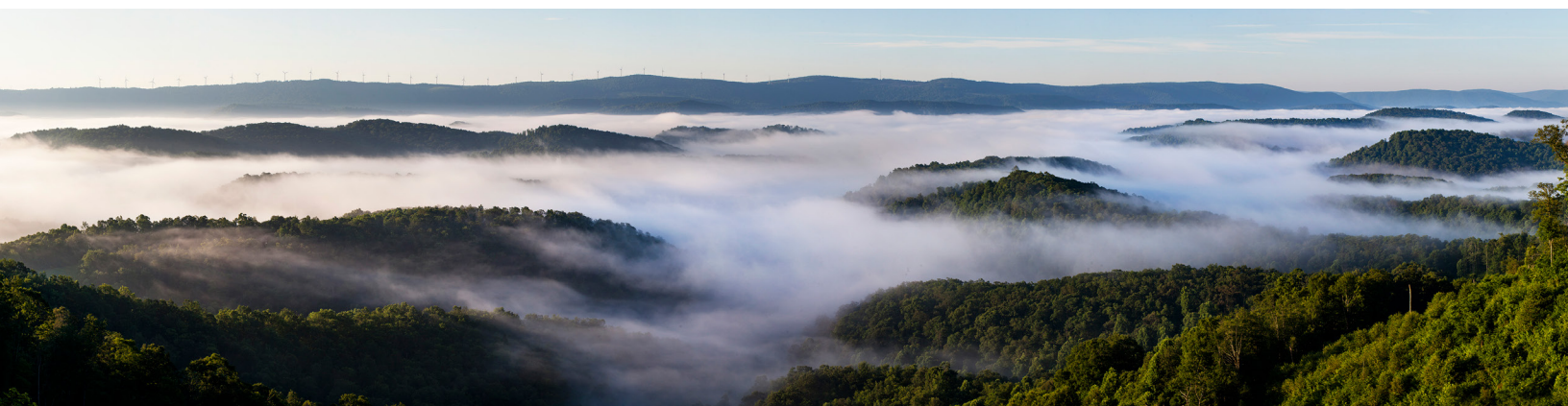
- Many CoPs already exist –Map existing CoPs and stakeholders; may not need to build a new CoP, just encourage participation in existing ones
- Identify/prioritize research, prevent duplication of effort, increase collaboration
- Identify specific objectives that people can relate to, start with smaller, manageable objectives and progressively move to the others
- Draft statements are too general, need to be more specific (e.g., commodity-level)
- Figure out what level of detail/expertise is needed

## COMMUNITY OF PRACTICE FUNCTION AND LOGISTICS

- Example from an existing CoP: Advantages: regular meetings; developed communication plan (Google Group and email) and charter (rules of engagement, vision) up front; Challenges: who will lead; how to sustain after grant support ends
- Consider focusing on a farm-specific adaptation strategy
- CoPs around topics (e.g., weeds, diseases) – mode will depend on topic/participants
- Do we lump or do we split?
- Discussion board (e.g., google groups/docs) – document sharing, connect people
- Farmer tools – social network, message board
- Field visit – some events / shared calendar

## NEXT STEPS

The Community of Practice team will synthesize and discuss the feedback provided during this session considering partners' input and an assessment of current state of community of practices in this space before proceeding to formulate solutions around this concept of developing communities of practice in our field.



*Morning view of the rugged Appalachian Mountains near Parsons, West Virginia. Photo: Gordon Dimmig, GradCAP Scholar, West Virginia University - used with permission*

## CLOSING REMARKS AND EVALUATIONS

*Facilitated by Erin Lane, USDA Northeast Climate Hub*

Appreciations were given to the Rutgers Logistics Team, The Hub Partners Meeting Planning Team and all land grant partners.

While weather prevented some from joining us, we had a tremendous turn-out and participation. We will consider feedback and options for a future partners meeting. In the meantime, let's continue our productive collaborations.

### EVALUATING THE SUCCESS OF THE PARTNERS MEETING

A formal evaluation was conducted to determine if the meeting objectives were met, to assist the planning team with improving future meetings, and to be informative to those interested in planning this type of event. Evaluation surveys were distributed directly after the meeting and by email in the weeks following.

### EVALUATION PARTICIPANTS

The meeting and evaluation participants included Extension specialists from Universities, federal and state agencies, the private sector, researchers, and farmers-- all of whom were invited to participate in the meeting. Based on attendee lists, RSVPs and head counts, approximately 150 attended the meeting. Sign-in sheets at the start of each day, estimated attendance at 128 individuals. Of the participants, 58 completed the evaluation with an approximate return rate of 45%.

Of those that completed the evaluation there were three categories of individuals; (1) researcher (50%), (2) Extension (43%), and (3) agriculture/forestry, government, and other, combined (32%). Respondents were able to select more than one category.

### KEY FINDINGS: OVERALL MEETING

- Respondents found the logistics of the meeting to be very well laid out, with positive notes for the dates, location, presentation topics, and activities.
- After the meeting, respondents are keen to be included in future NE Climate Hub meetings, and are interested in sharing details from this meeting with their colleagues.
- The day one plenary presentations were well received with respondents finding the theme of Identifying Impacts and Adaptations in the Northeast to be the most informative (87%), helpful for their fields (84%), and provided them with a new perspective (78%).
- Overall the concurrent sessions were thought to be:
  - ▷ Informative regarding: emerging research gaps, feasibility of an adaptation, and ways that the adaptation is being communicated
  - ▷ Lacking information on: costs related to implementation, mechanisms for implementing the practice, co-benefits for adaptations

## KEY FINDINGS: OVERALL MEETING (CONTINUED)

- When anticipating future behaviors, respondents most consistently indicated an effort to further their network, with the next highest being to engage in new research. Respondents did not frequently indicate trying a new adaptation, although this could be both due to the type of presentations as well as the bulk of respondents being researchers or extension.
- Overall the outreach presentations were viewed positively, with feedback indicating the most positive agreement for the outreach presentations: new ideas for outreach and consisted of appropriate topics.
- The community of practice sessions and exercises were received positively, although in general, respondents found them to be ‘useful’ as opposed to ‘very useful.’ The session A New Model for Building Collaborations was found to be ‘somewhat useful.’

## KEY FINDINGS: INDIVIDUAL CONCURRENT SESSION PRESENTATIONS

- **Concurrent Session 1:** Across all individual responses for this concurrent session, the presentations were viewed positively for feasibility of an adaptation practice and ways that the adaptation is being communicated.
- **Concurrent Session 2:** Presentation III: Adaptation Considerations for Climate Change Impacts for Coastal Areas, was the only session that all respondents agreed that the presentation addressed emerging research gaps (100%).
  - For the same session, all respondents indicated they would further their network because of their participation in this session (100%).
- **Concurrent Session 3:** Presentation II: Dairy and Livestock, was the only session that all respondents agreed on the strengths of co-benefits for adaptations (100%), and the feasibility of an adaptation practice (100%), with further near agreeance on emerging research gaps (92%), and costs related to the risk of implementing adaptations (92%).

## DISCUSSIONS AND NEXT STEPS

This two-day meeting of NE Climate Hub members and partner organizations was well received and found to be very informative, useful, and well-organized. The presentations were conducted by field experts and demonstrated a wide range of topics and approaches. Recommendations for future climate change work as well as future partner meetings are provided below.

- Based on the concurrent sessions, there is a need to increase research and outreach efforts on costs related to the risk on implementation, mechanisms for implementing the practice, co-benefits for adaptations, and ways to communicate adaptations. Involving agricultural economists and communication experts in program development, delivery and evaluation could meet this need.
- Increased networking and sharing opportunities for outreach presenters would be beneficial.
- Based on open comments, future CoP sessions need more clarity to be most useful.
- Future meetings should consider an ending session for the last day that is less discussion based.
- Future meetings should consider more environmentally friendly ways to conduct the meeting.